Claims

1. A method for sensing gases using a semiconductor diode laser spectrometer, the method comprising: introducing a sample gas into a non-resonant optical cell having reflecting elements; applying a step function electrical pulse to a semiconductor diode laser to cause the laser to output a continuous wavelength chirp for injecting into the optical cell; injecting the wavelength chirp into the optical cell; using the wavelength variation provided by the wavelength chirp as a wavelength scan, and detecting light emitted from the cell, wherein the method further involves using a chirp rate such that there is a time delay between spots on the reflecting elements sufficient to prevent light interference occurring in the optical cell.

2. A method as claimed in claim 1, wherein the duration of the pulse applied to the semiconductor diode laser is equal to or less than one microsecond.

3. A method as claimed in claim 1 or claim 2, wherein the duration of the pulse is less than the duration necessary for the optical output power to become zero after the drive pulse has been applied.

4. A method as claimed in any of the preceding claims further involving varying the rate of change of wavelength per unit time.

5. A method as claimed in claim 4 wherein varying the rate of change of the wavelength per unit time involves varying the amplitude of the current/voltage drive pulse.

6. A method as claimed in any of the preceding claims comprising adjusting the wavelength scan length.

7. A method as claimed in claim 6 wherein adjusting the wavelength scans involves varying the duration of the current/voltage drive pulse.

8. A method as claimed in any of the preceding claims comprising varying the semiconductor diode laser temperature.

9. A method as claimed in any of the preceding claims, wherein the semiconductor diode laser has output radiation having wavelengths in the region of 1μm to 14 μm.

10. A method as claimed in any of the preceding claims wherein the semiconductor laser is a quantum cascade laser.

11. A method as claimed in any of the preceding claims, wherein the cell is a Herriot cell.

12. A method as claimed in any of the preceding claims, wherein the amount of radiation absorbed is determined using an amplitude measurement of radiation transmitted through the sample and an amplitude measurement of a reference pulse.

13. A semiconductor diode laser spectrometer, preferably a quantum cascade laser spectrometer, for measuring radiation absorption by a sample, the spectrometer

comprising a semiconductor diode laser; a non-resonant optical cell for containing a sample gas and having reflecting elements at either end thereof; an electric pulse generator adapted to apply a substantially step function electrical pulse to the laser to cause the laser to introduce a continuous wavelength chirp into the sample cell, and a detector for detecting light output from the cell and adapted to use the wavelength variation of the wavelength chirp as a wavelength scan, wherein the chirp rate used is such that there is a time delay between spots on the reflecting elements sufficient to prevent light interference occurring in the optical cell.

14. A spectrometer as claimed in claim 13, wherein the duration of the electrical pulse is equal to or less than 1 microsecond.

15. A spectrometer as claimed in claim 13 or clam 14, wherein means are provided for varying the rate of change of wavelength per unit time of the chirp.

16. A spectrometer as claimed in claim 15 wherein the means for varying the rate of change of the wavelength are operable to vary the amplitude of the current/voltage drive pulse.

17. A spectrometer as claimed in any of claims 13 to 16 wherein means are provided for adjusting the wavelength scan length.

18. A spectrometer as claimed in claim 17 wherein the means for adjusting the wavelength scan are operable to vary the duration of the electrical pulse.

19. A spectrometer as claimed in any of claims 13 to 18 wherein means are provided for varying a starting wavelength point of the wavelength scan.

20. A spectrometer as claimed in claim 19, wherein the means for varying a starting wavelength point are operable to vary the semiconductor diode laser base temperature.

21. A spectrometer as claimed in claim 20, wherein the means for varying the temperature of the semiconductor diode laser comprise a thermoelectric heater/cooler or means for adjusting the duty cycle or the pulse repetition frequency of the repeated current/voltage drive pulses applied to the electrical contacts of the laser diode or means for adjusting the pulse amplitude of the current/voltage drive pulses or means for adjusting the base DC level of the current/voltage drive pulses applied to the electrical contacts of the laser diode.

22. A spectrometer as claimed in any of claims 13 to 21, wherein a beam splitter or other like element is provided to split radiation output from the laser into two components, the first component for passing through the sample and a second component that does not pass through the sample.

23. A spectrometer as claimed in any of claims 13 to 22, wherein the semiconductor diode laser emits radiation having wavelengths in the region of 1μm to 14 μm.

24. A spectrometer as claimed in any of claims 13 to 23, wherein the optical cell is a Herriot cell.

25. A spectrometer as claimed in any of claims 13 to 24, wherein the chirp has a frequency variation of about 60GHz.

26. A spectrometer as claimed in any of claims 13 to 25, wherein the applied pulse has a duration that is greater than 150ns, in particular greater than 200ns.

27. A spectrometer as claimed in any of claims 13 to 25, wherein the applied pulse has a duration that is in the range of 150 to 300ns, preferably 200 to 300ns.